Session 7D: Stormwater Problems and Solutions

Questions & Answers

Christopher May

[Question not recorded.]

A: Sure, since I signed the letter that was sent to the governor. I think it's totally inadequate, and it was a political decision based on backroom dealings, not science. That's my personal opinion.

Q: You said that the areas that had sufficient riparian buffer were not obviously all that developed. How close to development were they?

A: One of the streams that has good riparian conditions in one part of the stream is Swamp Creek, another one is North Creek. It's got some fairly intact riparian areas and we still see good, not great, conditions, but we still see fish and we still see bugs in those areas, although the development is upwards of 20 to 30 percent impervious. And even in some of those watersheds, you will note, like Swamp Creek, you've got Everett Mall and the highway in the headwaters, and as you move down to the stream where the riparian is still intact, the stream kind of heals itself a little bit by having the natural processes and functions that are provided by a stream riparian corridor intact. It does not get all the way back to natural course, but it does a fairly good job.

Q: What are the best management practices that you are doing now that are inadequate?

A: Basically now what we do is an add-on, an afterthought as we figure what the development is, we figure out how much impervious, we go the manual, we pull out some pond, some hole in the ground, something structural like that, perhaps we do some filtering of the stormwater, but the point is we don't try to make an overt effort up front to minimize the stormwater. It's like, here's what we got, let's deal with it, and we can't possibly deal with that water quantity that we have created, it's just not physically possible, you have to do something with that water. And part of the low impact development is to say to the people or developers, do whatever you need to do but we don't want any runoff coming off of your development. We don't care how you do it, just don't have any runoff. Of course, if you say that to somebody they probably say at first what are we going to do? But I think as we deal with this, we have good engineers and we think about these things and we finally realize that forest cover is a key, minimizing the imperviousness is a key, so we start looking at little stuff like infiltrating downspouts or doing something with rainwater with downspouts, using alternate surfaces on driveways and walkways and it may seem little but they add up. All these effects are cumulative and they all add up.

Q: Where should we pick where the riparian should start, where does the corridor start because issues of flooding and floodplains?

A: One of my slides had a little bullet on floodplains and channel migration zones. Many of our lowland streams don't have huge floodplains, some of them do but the river systems do. I think the riparian zone should actually be from the edge of the floodplain or the channel migration zone, if those exist, otherwise from the high water mark.

David Hartley
Q: Would you describe the mechanisms associated with turf that cause increases in runoff?

A: Typical development, forest clearing, the duff layers is removed often, it's heavy equipment that is moving through a site, top soil is often exported, all of those things add up to reduced soil moisture storage capability and reduced ability to infiltrate. On typical soils in King County at least are till-based soils which are the most dominant. That's a pretty substantial effect that increases runoff from suburban landscape or

from turf. Certainly, minimizing that type of clearing, smaller yards, and water conservation practices, I'll put another plug for that, drought tolerant grasses would be a very good thing on the flip side, which is the base flow side, which is also a really big impact. Forests kind of live within their means during stress periods, they hold water based on rooting depth, and they begin to shut down their operations when water is limiting. Golf courses and big suburban lawns have an effective rooting system that is as deep as the well that they are drawing the water from and it's being thrown out there and being shot out into the air in ET and that can have a really substantial impact on base flows compared to the forest environment.

Q: You showed only a 1 percent increase in a connected impervious in your basins, yet you had such an increase. How did you calculate that, were you including roof tops? My second question is about your wastewater infiltration issue, it's a great key point. How old is the wastewater collection system in that basin?

A: There are two terms that are used that basically mean the same thing. One phrase is "directly connected impervious area," another phrase is "effective impervious area"' as distinguished from what Chris was showing, which is "total impervious area." Total impervious area is very intuitive, you are flying over the landscape, you look down and you see the roofs, you see the pavement, you see the asphalt of streets, total it all up, and that's total impervious area. In suburban landscapes and in rural areas, not all roofs for example, end up contributing runoff directly to streams. When you have an isolated barn somewhere, the water falls off the roof, and a lot of it perks into the pasture and it doesn't have the same kind of effect as a downspout, which is piped to a drainage system, to a gutter in the street, and directly to the stream system. So there has been research in urban hydrology, it has been done over many years that has a way of relating on average total impervious area to what we call effective or directly impervious area. And what you find out is, in a commercial area like in the Duwamish or downtown Bellevue, total impervious area and effective impervious area are almost the same. As you get down in land-use intensity the divergence begins to increase, and in rural areas it is very typical to have effective impervious be half or less than half of total impervious area. It's not a precise thing, it's conceptual and intuitive, and it's been analyzed actually using runoff response in a range of different land-use intensities to calibrate it. The age of the wastewater collection system is highly variable, as you can imagine, depending on the vintage of development, the example was for the entire Cedar Lake Washington watershed, which includes very old areas which have combined sewers for stormwater and wastewater in the City of Seattle, are commingled in a collection system as well as probably a lot tighter systems in the new areas which have lower inflow and infiltration into the sewer system. In the King County Regional Wastewater Services Plan that came a year or two ago, there was information about our estimates of inflow and infiltration to the wastewater system by sewer subbasins, so we have estimates and we are now actually involved, the county is involved in a pretty comprehensive monitoring program to tighten down what the variation in inflow and infiltration and leakage into their wastewater system is and how it varies from place to place. We are measuring that now, spending quite a bit of resource to do it.

Q: What you had to say about upper Bear Creek is a cliché and what is King County going to do about what we are seeing happening in upper Bear Creek?

A: Well, we are going to share the responsibility, of course, with Snohomish County because they have a chunk of it, too. But actually, we absolutely—in responding to the Endangered Species Act—have to tighten up our approach, and we have tightened up, since the Bear Creek Basin plan was completed or worked on in about 1985 and it was passed a few years later. The detention standards that were in that basin plan were not adequate. We have beefed those detention standards considerably, unfortunately, allegorically, we're behind the curve and so we allowed yes, some change to occur. It's very difficult to impose on somebody who is a single parcel developer the onus of building a detention pond because they want to clear three acres of their 20-acre parcel, which does have an effect but it is quite difficult, but we have tightened our detention standards considerably since that development that caused those changes occurred, which is not a panacea as Chris mentioned because there are many other effects besides peak flows that are affecting habitat quality and I might add the BIBI scores for upper Bear Creek are really kind of in the fair range. Even though we have more than half the basin in forest cover and the BIBI score, there's less monitoring going in Evans Creek, but it's not fair, it's kind of low. It's in the low 20s for Evans

Creek, so there are some things that need to be done, restoration wise and in tightening up our regulations, yes.

Sarah Morley
Q: Do you find that the LandSat image was adequate for your analysis at the local scale?

A: To some degree it was, we actually were hoping to look at local scale at even a finer scale than what I presented here and also riparian. We took the fine riparian as a 200-meter buffer, realistically that's not what's really on the ground in these urban creeks, so the reason we limited to 200 because given the resolution of the dataset, which is about 30-meter by 30-meter pixels, we really couldn't look at anything more narrow. The resolution wasn't high enough. It was high enough at the scale we defined it, but it would certainly be interesting to look at even a more local scale and for that, I think you would need higher resolution geographic data.

Q: What are some of the factors that you are thinking are the most important for biological integrity? It seems like you have riparian integrity, hydrologic integrity, physical integrity, as you begin to think about this in relation to all the different impacts of urbanization?

A: I am kind of reluctant to point out just a couple, saying these are the most important, for one thing, there is so much to be done, you are always finding out new things like for instance, the recent studies have indicated that low levels of pesticides are affecting homing mechanisms with some salmonids. I'd certainly say that riparian…having good riparian quality is definitely critical, but I don't think little oases of buffers in urban watersheds is going to be enough by any means. Hydrologic impact in urban basins is also definitely going to be critical and might potentially overwhelm any of the corridor benefits. I guess I'd probably say those are the big two that stand on my head but then again, those are the two I am most familiar with. I think water quality is something we kind of push to the side for a little while and have it looked at as much recently maybe there's other ways that is interacting that we are not aware of.

[Question not recorded.]

A: You'd think there would have been. I think Chris May has done some of that, I think Chris looked at the relationship between BIBI and the coho-cutthroat ratio and there was some correlation. So those two were related. It would be nice to look at some other measures, too, and I believe Rob Plotnikoff of the Washington Department of Ecology has done some of that in some basins in Snohomish County.

Q: You had mentioned that you felt that at least statistically, the data explained better than half of the variance in BIBI when you combined the subbasin land cover and the local land cover. Not necessarily directly from these data but from your knowledge as a biologist, what do you expect the rest of the variance is being explained by or being caused by?

A: Local scale and subbasin urbanization explain about 60 percent of the variability of the BIBI. Our local scale maybe wasn't local enough. Maybe there are things happening at a yard-by-yard basis. Somebody is applying pesticide here; something extremely local that we are not necessarily capturing. That could be physical habitat condition. Is it really channelized at that particular point? Is there a chemical water quality contaminant issue? Biotic interactions? Are there invasive species that we are not looking at? And, as Chris mentioned, it's not just is there some greenery on the side of the creek. it's also the quality of that greenery, and that's not something we really distinguished in our analysis. And in urban creeks you might have some buffer, but a large part of that is overtaken by exotics. That is something that is not captured with this model.

Christopher Konrad
Q: Could you explain those maps?

A: Yes, the pink is till, the blue is advanced outwash, and the green is recessional outwash, and depending on where you are, basically it's at the transition between the till in either form of these outwash deposits. The outwash deposits are going to be much more porous and permeable than the till. The till is quite silty, it

doesn't have a lot of storage volume, the aquifers around here at least the shallow ones are commonly in the outwash deposits, so where those deposits are expressed at the surface is where we would expect to see perennial flow.

[Question not recorded.]

A: Yes, Vashon Island, Puget Sound, this is the Green River coming in through here, so the Duwamish here, this is the southern end of Lake Washington, this is May Creek, Cedar River, this is the Soos Creek basin, this is Miller Creek, Longfellow Creek, Des Moines Creek, Hylebos Creek. Sorry I didn't explain that earlier.

Q: Did you take your dataset and basically stratify it by the geology and then see if there's a difference between land use?

A: I didn't do that. One of the issues, if you look at this basin, I think it would be somewhat arbitrary to do that unless you really had a single dominant deposit that the stream mostly was on.

Q: If there were more extensive influence on recharge or reduction on recharge would you see an effect then?

A: To the extent that it effects groundwater surface elevations that may be the case, in other words, these aquifers have to be drawn down so that we would actually start to see a reduction in the length of stream. I would guess that though that actually the stream is a pretty good measure of that because a small change in groundwater surface elevation, you have streams at a very low slope, if you have a small change in where that groundwater is coming into the stream, you'd expect to see a fairly large change in the length of stream. Groundwater pumping is certainly another issue here.

Q: You compared urban versus suburban, are you aware of any work comparing suburban-urban versus rural?

A: No, not as far as this type of work goes. I did include some basins that are fairly rural and I was lumping them into this suburban category. If we can consider for a moment perennial stream density and road density, I had some points that were fairly low development, certainly not forested by any means, it is difficult to find basins like that in the lowlands.

Q: Can you go beyond the presence/absence of flow and say something about the quantity of flow in these basins?

A: My focus was presence/absence of flow at a point and I guess quantity of habitat, so the length of stream. So I think we can say something about the quantity of habitat in that we are not seeing any significant differences between the quantity of perennial aquatic habitat in suburban versus urban streams or any relationship between the quantity of perennial habitat and road density, which is a surrogate for urban development.

Q: Just a follow-up on that. Wouldn't you agree that habitat has other dimensions besides the length?

A: Yes I would and perennial habitat is only one type of habitat, perhaps for some organisms in fact, the amount of habitat available in August is inconsequential because the organism has deposited eggs and is out of the stream, they have already migrated out of the smaller reaches or what not. So this is just one facet.

David Hartley
Q: What is the degree to which imported water in the summertime from irrigation, and I am not sure what the magnitude of that might be, but I am guessing it could be on the order of a foot or two at least in developed areas, what is the likelihood that the magnitude of that imported water in fact is a

reasonable balance for the big surface runoff arrow of Chris May's that is denied the groundwater system during the wintertime as a consequence of urban land cover?

A: I have to make sure I am getting your questions correctly. Are you asking whether there is a balancing off of the loss of water because of quick runoff in the winter from imported water for irrigation? I think it's first of all, it's important to make the distinction that I was trying to get at with my question which is presence/absence is not the same as flow quantity. That's obvious on it's face. Probably much of imported water is actually consumed, but of course people don't always follow the recommendations for lawn watering, and they are often over-watering, so there is going to be some recharge effect from imported water in an urbanizing basin. There will also be water that runs off impervious surface and ends up in wetlands, for example, in the summertime, because of thunderstorms that otherwise might have perked in. Last of all, I want to make sure that by my examples of what we saw in upper Bear Creek and Evans Creek I did not give the impression that I am suggesting that in all urbanizing situations we would be losing base flow. I can imagine in outwashed-dominated rural developed subbasins that all that the general picture of compaction that we talked about that is cutting off recharge is not as big a factor because the soils are so porous in the first place that the increment of compaction that occurs is probably not enough to significantly cut off recharge. So in outwashed dominated basins, like the Rock Creek basin, that has been mentioned here today, I don't expect a loss of recharge from conversion from forest to pasture or grass. That urbanization might not be causing a base flow impact there. I think it's variable, and I think the degree of water import and export changes from subbasin to subbasin.

Q: I have a question for the whole panel. It's sort of bringing us back to what was brought up at the opening session about connecting the dots and bringing some of this into the policy realm. One of the best tools for addressing the Clean Water Act needs that Sara brought is the NPDES permitting process and the Phase I Municipal permit under construction right now, so to speak, and there is a tremendous resistance on the part of the permitees under that permit to make any of the changes to our stormwater and management approach that are going to be necessary (a) to protect what we have that is still working and (b) to begin to sort of do some retrofit and redevelopment to reclaim some of the things that we have damaged in the past. My question to the panel is (a) am I correct that if we summon the political will, can we protect what we have that is in good shape and (b) if we summon even more political will, what is the likelihood of actually being able to restore what we have already damaged?

A: Well, as the moderator, I get to answer that first. Those who are NPDES permitees do not have much under their jurisdiction, frankly, that would meet any objective criterion for preservation, at least on a watershed scale. The NPDES permitees are those of large populations, I guess I'm thinking more of the cities. There are certainly areas in some of the counties that do have undeveloped areas that are both low human impact and high biological conditions. There are programs within some of those jurisdictions to purchase and protect them. Whether or not they are sufficient or adequate is a question. I think that those of us who have worked in urban streams abandoned the concept of restoration a long time ago. We recognize that there are opportunities for rehabilitation and we do see a distinct difference between them. In the urban stream project that both Chris, Sara and I have worked on, we recognize that probably the highest candidates for rehabilitation are those [that] show relatively low levels of human impact as we measure by something like land cover, which is very difficult to fix, and yet despite having fairly low amounts of urban land cover, nonetheless, have quite depressed biological conditions and it makes us suspect that some of those other factors may be the cause of those depressed biological conditions. And because we are feeling so overwhelmed in our inability to address land cover problems, perhaps these are the best candidates to try and figure out what else has gone wrong that has perhaps more amenable to rehabilitation. To be able to identify that requires a fairly systematic approach to biological monitoring as well as land cover assessment. One is expensive, the other is cheap. And you are right, there is reluctance of any jurisdiction, even the very well meaning ones, and there are many here. To spend money in the name of assessment, there is great political will to throw huge sums of money on just doing something, doing anything. Those of us who have been evaluating some of that work are not certain that's always the best way to spend the money, but from the regulatory agencies, the political powers that be and the public, the desires to do something, to build something, to put a plaque on a log and insert it into a stream. Our concern is simply we are not sure that we are getting an advantage, and I don't know how to change that dynamic. I think it

takes a better informed citizenry. I think it takes regulatory agencies that are not going to be satisfied with just X number of dollars being spent on projects as the metric of whether or not you are doing a good job, and it takes the agencies willing to do that as well. But I think in many ways, the agencies themselves and staff within the agencies are ahead of both the public, the politicians, and even some of the regulators.

Q: For those watersheds that cross jurisdictional boundaries, how does one jurisdiction know or ensure or work with another jurisdiction to achieve whatever the desired management process and outcome might be?

David Hartley
A: I think that some people in the room must be aware that there is in fact a Tri-County cooperation that is going on in King, Pierce and Snohomish in terms of Endangered Species Act response and that was kicked off and has been in very much supported by the county executives from all three. And going back in time when King County had a basin planning program, we very much did pursue inter-jurisdictional cooperation. We did have cooperation with Snohomish County in developing the Bear Creek basin plan and at least getting some level of uniformity in the application of detention standards, which did turn out to be inadequate, but at least they were that across the board. So cooperation is not impossible. It's difficult to do, but we are in fact working on it. I would just like to say something about a previous question because it does in a way relate to this jurisdictional issue. An ounce of prevention is worth a pound of cure and that really goes big time within the watershed protection, conservation and restoration issue. We can spend tens of millions of dollars on little highly urbanized creek systems to try and get back a little bit of ecological function. Resources are always limited, and that money could be spent probably better in protecting buying development rights, protecting stream corridors in highly functioning systems which still do exist in rural areas and for those of us who live in the wealthier jurisdictions like the City of Seattle or the City of Bellevue. Citizens really need to lobby hard to their political leaders to be willing to spend coin in the rural areas and maybe outside their jurisdiction in consort with other jurisdictions. That would my political plug for the day.